NASA/IITRI

MANUFACTURING APPLICATIONS TEAM

IIT Research Institute 10 West 35th Street Chicago, Illinois 60616 312/567-4191

1979 YEARLY REPORT

CONTRACT NO. NAS8-32229, MARSHALL SPACE FLIGHT CENTER, ALA.

SOLVING INDUSTRIES' MANUFACTURING PROBLEMS THROUGH AEROSPACE TECHNOLOGY

Report No. IITRI-J6499 — Yearly Report

MANUFACTURING PROCESS APPLICATIONS TEAM (MATeam)

Mr. James H. Ehl, Chief
Tooling Applications Branch
Materials and Processes Lab (EH 44)

Prepared by

Edmund R. Bangs
IIT Research Institute
10 West 35th Street
Chicago, Illinois 60616

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FOREWORD

This report describes the activities of IIT Research Institute's Manufacturing Applications Team (MATeam) during the third program year, February 1, 1979 to January 31, 1980.

Program progress has been directed toward stronger concentration on the development of RTOP applications engineering programs and the promotion of industry funded applications programs. There are a total of eight RTOP programs that are in various stages of progress; they include the Orbital Tube Flaring Device, Infrared Proximity Sensor for Robot Positioning, Laser Stripping Magnet Wire, Infrared Imaging as Welding Process Tracking System, Carbide Coating of Cutting Tools, NDT Fracture Toughness Testing Titanium, Portable Solar System for Agricultural Applications, and Anerobic Methane Gas Generator. MATeam maintains a supportive role in the ion beam technology RTOPS at Lewis Research Center. The industry funded programs in progress include the Adams Manipulator Arm and the Bolt Tension Monitor.

There were four technology transfers in which industry implementation has been initiated: the Wire Selector Calculator, the A-C Motor Control (Modified Design), the Bearing Failure Detector and the Magnetic Hammer Coil Design.

The Team continues to focus on identifying manufacturing problems and technology opportunities in the industrial sector as well as with other government agencies.

In addition to the author, the following Team members have made meaningful contributions to the program: Mr. Victor Fischer, Manufacturing Analyst; Mr. Thomas Jacobius, Economic and Market Analyst; Mr. James Wiggins, Manufacturing Consultant; Mr. Jack Williams, Manufacturing Advisor; and Mr. Peter Grinstead, Manufacturing Analyst.

The work described herein was conducted under NASA Contract NAS8-32229. Mr. James H. Ehl, Marshall Space Flight Center, served as the contracting office's representative.

We are pleased to submit this report and anticipate continued success in future years.

Respectfully submitted,

IIT RESEARCH INSTITUTE

E.R.Bangs
MATeam Director

APPROVED:

R.S.Levi
Manager
Technology Transfer and
Market Research Section

ERB:ds

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LIST OF ENCLOSURES

GLOSSARY

NASA Centers

NASA HQ	NASA Headquarters
NASA HQ TU	NASA Headquarters Technology Utilization
ARC	Ames Research Center
NASA-Michoud	NASA Michoud Assembly Facility (Shuttle Tank Mfg.)
JSC	Johnson Space Center
LRC	Langley Research Center
LeRC	Lewis Research Center
MSFC	Marshall Space Flight Center
NSTL	National Space Technology Laboratories
JPL	Jet Propulsion Laboratory

Department of Energy (DOE) Codes

DOE HQ	DOE Headquarters

Department of Defense (DOD) Codes

WPAFB	Wright-Patterson Air Force Base
WPML	Wright-Patterson Air Force Base Materials Laboratory
PRAM	Productivity, Reliability, Availability and Maintability Program - WPAFB
NAS-NARF-NORIS	Naval Air Station, Naval Air Rework Facility, North Island, San Diego, Calif.
NAS-NARF-Norflk	Naval Air Station, Naval Air Rework Facility, Norfolk, Va.
ECIP	Energy Conservation Investment Program (Navy)
NSRDC	Naval Ship Research and Development Center (Annap. MD.)

1. SUMMARY

The third year of MATeam operation has been a year in which Team effort has been concentrated on the development of RTOP programs with a de-emphasis on direct technology transfer activities.

The MATeam program continues to grow in acceptance and is presently considered by representatives of the major industries to be the communication link to aerospace manufacturing technology. During the program year problem definition, as well as the preparation of RTOP programs, has been initiated with DOE, Naval Rework Facilities at Norfolk and San Diego and the PRAM Office WPAFB. There was a total of 19 presentations given during the program year and a total of six technology demonstrations. A combined total of 30 representatives attended the technology demonstrations from industry and other government agencies. Most notable of the presentations were those given to the Grotnes Machine Works, the Illinois Tool Works, the Robot Institute and the PRAM Office of WPAFB. As a result of the presentations, activities are underway in RTOP programs related to Orbital Tube Flaring, Carbide Coated Tools and a Robot Proximity device. During the PRAM office presentation, several major Air Force manufacturing problems were identified which will initiate active MATeam problem screening and assessment effort across government agency boundaries.

The Orbital Tube Flaring Device and the Robot Infrared Proximity Device have the strongest potential to become RTOPs and eventually have strong industry impact. The direct technology transfers that have reached the level of widespread dissemination include the Modified Heavy Duty A-C Induction Motor Control and the Wire/Selector Calculator.

A total of 57 problem opportunity statements have been added to the program establishing a list of 182 active statements. A total of 8 statements have reached the applications project stage, and four have achieved the level of implementation.

In summation, the program year has been one in which increased interaction with other government agencies has occurred; and the effort devoted to the promotion of joint government industry NASA applications engineering programs is now starting to show significant potential.

2. INTRODUCTION

The objective of the MATeam is to successfully transfer aerospace technology to solve key problems in the manufacturing sector of the economy. The underlying purpose for the Team is to increase the return of the Nation's investment in aerospace research by fostering wide implementation and use of NASA technology and expertise. The function of the Team in accomplishing this objective is to provide an important intermediary role between technology sources and technology users in order to: improve the communication process; assist in the movement of new technology across organizational and disciplinary boundaries; and shorten the time between technological development and its broad and effective implementation.

NASA's decision to sponsor an Applications Team to effect technology transfer in manufacturing was both timely and appropriate. The United States, while still ahead of other industrialized nations in terms of overall manufacturing capabilities, innovation and state of technology, is diminishing in its productivity position. The problem is becoming increasingly severe because of the continual rise in the cost of energy, raw material and labor and the need to maintain our competitive position in the world market. Clearly, a way to combat this growing national problem and maintain our competitive advantage is to capitalize upon and to speed up transfer and adaptation of new manufacturing technologies into the industrial sector as well as other government agencies.

At a time in history when industry must be flexible in maintaining a competitive market position, achieving technology transfer, the widespread implementation application of new products and processes, is not something that occurs quickly. In order to bring about successful technology transfer, industry problem areas and market needs must be matched with solutions that are both technically sound and economically feasible. This matching of needs with solutions does not guarantee technology transfer; it is necessary to establish effective means for commercializing the new product or process. The MATeam's task has been analogous to that of identifying and implementing new business opportunities and carries with it the many pitfalls normally associated with new venture development activities. The approach used by the

MATeam is structured to insure that the Team's efforts are focused in bringing about successful technology transfer and that the common pitfalls are avoided.

Responsibility for the MATeam resides in the Technology Transfer and Market Research Section at IITRI. The Team organization is shown in Enclosure 1. The Team members possess a unique mix of capabilities and experience in manufacturing technology and technology transfer. In addition to the individuals shown, the Team relies extensively on staff members within other IITRI research divisions for their expertise in specialized areas relating to manufacturing technology.

3. TECHNICAL RESULTS AND PROGRESS

3.1 Research and Technology Objectives and Plans

The MATeam concentrated its activity during the program year in the identification of RTOP programs with government agencies and with companies whose problems are reflective of the industry they represent. A summary discussion of the potential RTOP programs supportive activities follows:

Industrial Applications of the Orbital Tube Flaring Device (MAT-168) - NAS-NARF-NORIS are presently overhauling several F-4 aircraft. The overhaul includes the replacement of small diameter flared tube assemblies. Using conventional flaring tools considerable cracking has been encountered. A demonstration of the orbital system to Navy personnel at MSFC (11/24/79) produced excellent flares in the small diameter tube. NAS-NARF-NORIS expressed interest in obtaining the orbital system. Two orbital tube flaring systems have been shipped to the San Diego rework facility. The systems forwarded require modifications in order to offer complete orbital capabilities.

Grotnes Machine Works has offered a proposal to NAS-NARF-NORIS that describes a modification program to update the system. Due to the large amount of engineering required and the preparation of drawings not available on the old model machine (Leonard Mfg. Co. - now out of business) the cost to modify the machine is estimated at $90,000.00. A joint funded program is presently being reviewed between MATeam, MSFC and NAS-NARF-NORIS personnel to accomplish the modification.

The Generation of Methane from Biodigestion for Industrial Heat Treating Applications (MAT-291) - The Naval Air Rework Facility (NAS-NARF-NORFLK) presently consumes 1.0 to 1.5 million cubic ft. of natural gas to meet their heat treating furnace requirements. The NASA Anerobic digestion system, "Fuel Gas From Biodigestion" MFS-23957, R.D. McDonald and W.C. Wolverton (presently at NSTL) is the technology of interest. Mr. W. Maxwell of NAS-NARF-NORFLK in a letter to MATeam had indicated that there are Navy funds available and has expressed interest in a joint funded program.

MATeam is presently assessing the uniqueness of the technology and has created interest in the program with DOE-HQ. It has been requested of NSTL that an RTOP be prepared and a market survey request be initiated at NASA-HQ.

When an RTOP program plan has been prepared, the MATeam will review the plan with DOE and Navy representatives to define their role in the program.

The Application of Sensor Technology for Robot Positioning in Automobile Manufacturing (MAT-293) - The requirement for accurately positioned parts on the production transfer system has created excessive tooling and robot costs. A sensing system is needed that will sense the position of the part to be fabricated and accurately inform the robot of the part's position. NASA vision proximity devices developed by JPL under Contract NAS7-100 appear to provide a solution to the problem. Enclosure 2 is an artist's concept of the proximity device that will project three beams that have the ability to sense interference, measure distance, feedback to the robot computer and determine the location at which the robot must position itself. The three beams will define the true position of the weldment relative to the X-Y-Z axis.

The second problem application for the sensing technology is in general sheet metal fabrication and the automotive industry in the forming of sheet metal parts. A robot application, which continues to expand, is in press forming operations in which the robot loads the blank in the die and removes the completed formed part. Frequently the formed part becomes tangled in the die as shown in conceptual sketch (Enclosure 3). Costly damage has occurred when the ram has dropped anticipating the next blank, striking the tangled part and seriously damaging the die set and robot arm. The same vision proximity device being considered for application in the positioning problem above may be applied here. As shown in Enclosure 3 the proximity device will be mounted on the robot housing and will transmit a beam to determine if the die has been emptied. If the die set is not completely clear the sensor will signal machine stoppage.

An interest in joint funding has been indicated by Mr. J. Engelberger, President, Unimation Inc. He estimated that funding in the amount of $30,000.00 (facilities and manpower) can be made available. The principal JPL scientist involved is Antol K. Bejczy who is presently preparing an RTOP describing the goals and objectives of the program. It is anticipated that the deliverable item will be a prototype proximity system that will be adaptable to any robot. The device will be marketed by Unimation Inc.

The Laser Wire Insulation Stripping System (MAT-175) Johnson-SP-510/ The Kearfott Division of Singer will have Laser Inc., (a division of Coherent Inc.) build the NASA (Rockwell) stripping system for magnet wire stripping applications. Since modifications will be required to the stripping system to accommodate the small diameter (less than AWG #24) wire, a joint funded program proposal is being prepared by Kearfott and will be forwarded to NASA-HQ. for consideration. It is anticipated that the overall system will be built for less than $25,000.00

Extending Cutting Tool Life Using Ion Beam Applied Carbide Coatings (MAT-285) - Short cutting tool life in our machining industry continues to be a major problem due to the increased cost of cutting tools and the concern for increased productivity. The application of a hard coating (e.g., tungsten carbide, titanium carbide) has effectively extended tool life. However, problems have been encountered with the coating falling off. The Illinois Tool Works Inc. (Chicago) has expressed interest in evaluating titanium carbide coatings that have been applied to their tools using the Ion Beam Coating Process at LeRC. The major tool builder has offered to provide $ 000.00 in facilities and manpower to evaluate coated samples. Cutting tools have been forwarded to LeRC and are awaiting coating when manpower is available.

The Control of Fusion Welding Processes Using Infrared Imaging (MAT-294) - A major aircraft industry welding problem at the WPML is the problem of controlling the welding process when it is necessary to weld blind sided joints (accessible from one side). The blind sided joint has a negative influence on the essential variables of the welding process which promotes various rejectable defects. It has been determined that changes in the essential variables of the process or changes in the base material (e.g.,part fit, differences in thickness) change the geometry of the weld puddle. A review of NASA infrared imaging technology developed at ARC (Dr. H. Lum) indicates strongly that the system has the potential to monitor puddle geometry, compare the image to a reference image and signal the welding system of process changes that forecast potential defects (Enclosure 4). WPML has expressed interest in a program that will demonstrate the feasibility of the system. ARC (H. Holl v) is preparing an RTOP that will describe the technical goals of the program. MATeam will define the proposed Air Force and NASA funding plan.

The Manufacture of a Portable Solar System #4 (MAT 295) - The Cook Company of Chicago, IL has indicated to the MATeam that they are interested in the design , manufacture and demonstration of a portable version of the DOE/NASA SIMS Solar System #4. The system will have application to the agricultural market for grain drying and the heating of livestock housing. Cook has been directly involved in the market analysis and the modular manufacturing cost estimate for the existing prototype #4 presently at Jackson, Miss. The Cook Company will combine their building construction expertise with L.C. Kohlman, Inc., a major Chicago mechanical contractor and will offer a program proposal to MSFC in March.

The Nondestructive Measurement of Fracture Toughness in Titanium Weldments (MAT-246) - The NSRDC are presently fabricating deep submergence research vessels in titanium alloy. Weld cracking problems have been encountered during fabrication of hull sections. There is the need for a nondestructive testing process that can measure fracture toughness in completed welded joints. The need has increased in intensity now that there is a requirement for submarines with titanium hulls.

It appears that the most effective means at this time is the nondestructive ultrasonic measurements developed at LeRC (A. Vary). In Task 3 of IITRI Proposal 80-64J it has been proposed that NRDC evaluate the process. Welded samples of the titanium alloy would be forwarded to LeRC for testing. The proposed funding level for the task has been estimated at $41,143.00. The possibility of additional NASA funding has been discussed with NRDC personnel if they consider pursuing the task.

In addition, MATeam has maintained a supportive role in the ion beam technology RTOP programs underway at LeRC. Initial MATeam contacts with industry regarding the proposed liquid crystal programs has produced mixed response. General Motors Corp. (A-C Spark Plug Div.) feel an improved texturing process is required since the present buffing process has a high rejection rate and has caused production delays. The Air Force is considering replacement of their liquid crystal systems with an electrofluorescent paint due to the limitations of the liquid crystal with temperature and humidity.

In view of the initial response a market survey was performed to substantiate or reject in greater detail the uniqueness of the proposed LeRC program direction. The IITRI market survey (to be issued) indicates

strongly that the ion beam texturing and fabrication proposed has the potential of strong impact on the liquid crystal industry.

3.2 Direct Technology Transfers

There was a total of four direct technology transfers during the program year. The direct technology transfer is defined as a transfer that does not include NASA applications engineering funding and is not directly involved with a proposal response. As part of the direct transfer, the MATeam provides the essential communication link between the technology recipient and the Technology Utilization Program. The strong communications system speeds up transfer and dissemination of technology by identifying key scientific, engineering and legal personnel at the applicable field center for the technology recipient. MATeam transfer announcements to the media has also speeded up the transfer process. A discussion of the technology transfer and dissemination status follows.

The Wire/Selector Calculator (JSC MSC-16632) is presently being marketed by Electronic Relays, Inc., Downers Grove, IL. and Space Technology Inc., Chicago, IL. Both organizations are presently taking orders for the calculator. Space Technology Inc. will market the device in engineering and educati[illegible] markets. Electronic Relays Inc. will offer the device as part of the controller package.

A non-exclusive patent license has been issued to Vim Systems Inc., Syracuse, N.Y. for manufacture and marketing of the total Adams Manipulator Arm System (MSFC Tech Brief B73-10204). Arm components are presently being manufactured and assembled, the first prototype will be completed in 1980. Vim will offer the device to the assembly robot industry.

Endevco Inc., San Juan Capistrano, Calif. is presently marketing the Early Warning Bearing Failure System. The initial ultrasonic and acoustical testing done as a basis for the system was performed under contract to MSFC (NAS8-29916). Endevco continued to develop the device until its formal release to industry in November, 1979. The system will detect problems in bearing performance by reading and classifying the sound vibrations emitted from a bearing system. Thus, the system, shown in Enclosure 5, can monitor the bearing noise and forecast failure. Applications include large pumps and turbines,to name a few.

The modified design of the A-C Motor Control has been transferred to Furnas Electric Co., of Batavia, IL. Furnas has created their Nordic Controls Division specifically for the NASA device and is presently in production manufacturing single phase units at horsepower ratings ranging from 1/3 to 3.

The Magnetic Hammer Coil (NASA Patent 3,360972-2-1968) has been transferred to Maxwell Laboratories, Inc., San Diego, Calif. The transfer was brought about by the MATeam demonstration of the electromagnetic forming system to Maxwell representatives at the NASA Michoud Assembly facility on November 24. Maxwell is presently preparing an application for a nonexclusive license. They will make the coil available as part of their product line.

3.3 Market Study Activities for Potential RTOP Programs

In order to provide a firm basis for guidance in the planning and funding of RTOP programs, a preliminary market survey is frequently performed. The report substantiates the uniqueness of the technology involved in addition to providing a preliminary insight into its market potential. There has been a total of three market survey requests submitted as shown below.

RTOP NO.	Title	Contact
141-95-01-18	Utilization of Ion Beam Technology in the Fabrication of Liquid Crystal Displays	NASA-HQ
141-95-01-11	Industrial Bonding Applications of Ion Beam Textured Fluoropolymers	NASA-HQ
To be Assigned	Fuel Gas from Biodigestion Tech Brief MFS-23957 Industrial Heat Treating Applications	NSTL

Requests for market surveys to substantiate direction in infrared technology RTOP programs are presently being prepared.

3.4 Problem/Opportunity Statement Status

MATeam contact with the Air Force, Navy and Army, in addition to expanding reputation with industry, has resulted in a significant amount of problem/opportunity statements. The increased amount of technology demonstrations and effective use of the news media has identified several additional statements. During the program year there was a total of 57 new

statements added to the present active list which totals 182. A tabulated summary of statement screening and assessment activity is contained in Enclosure 6.

3.5 Company Contacts, Technology Demonstrations and Press Releases

During the program year there was a total of 285 new company contacts. There were 19 presentations given to selected companies and government agencies (Enclosure 7). All of the presentations were productive in that problem/opportunity statements were defined and in some instances RTOP activity has been initiated. The presentations that produced RTOP interest include Illinois Tool Works, WPML, PRAM-WPAFB, and Unimation Inc.

Technology demonstrations at various field centers continues to be an effective means to expose technology, identify problems and initiate the transfer process. A total of six technology demonstrations were performed during the year at MSFC, NASA-Michoud, Rockwell International and JPL. A list of the demonstrations and attendee companies is included as Enclosure 8.

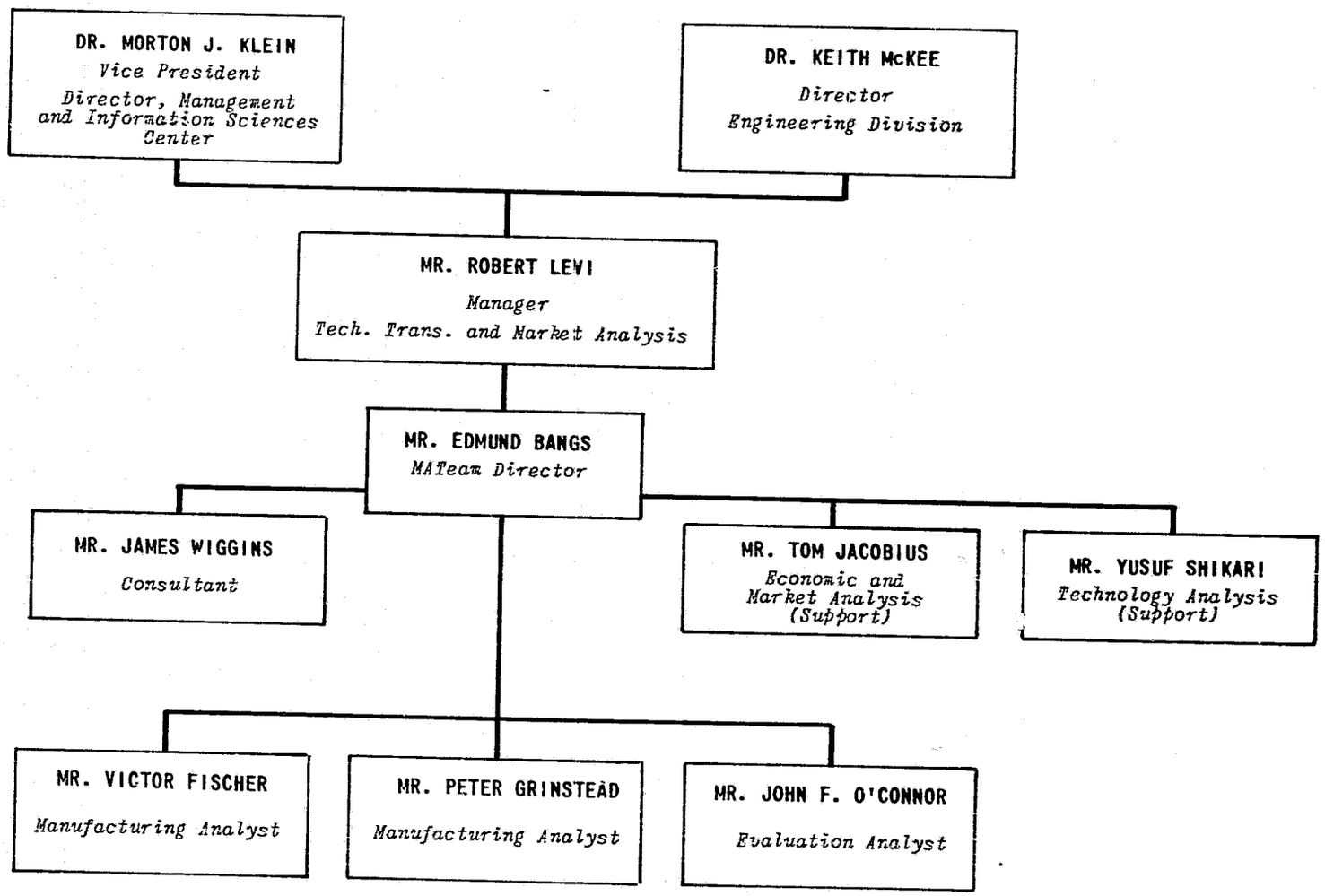
The demonstrations were conducted with potential problem solving technology in response to problems that had been identified related to the flaring of small diameter tube, stripping insulation from wire, removing distortion from aluminum weldments and positioning sensors for robots. The status of the potential RTOP programs is discussed in Section 3.1.

The use of press releases to announce equipment demonstrations, presentations and other MATeam activities continue to attract new industrial participants in the Technology Utilization Program. The press releases released during the program year are included in Enclosures 9, 10, 11, and 12. It is estimated that at least 16 articles were published in magazines and trade journals in response to the press releases. Articles appeared in American Machinist, Electric Light and Power, and Tooling and Production magazines, to mention a few. Enclosures 13 and 14 are two articles that appeared in Production Engineering and Welding Design and Fabrication Magazines.

4. SUMMARY

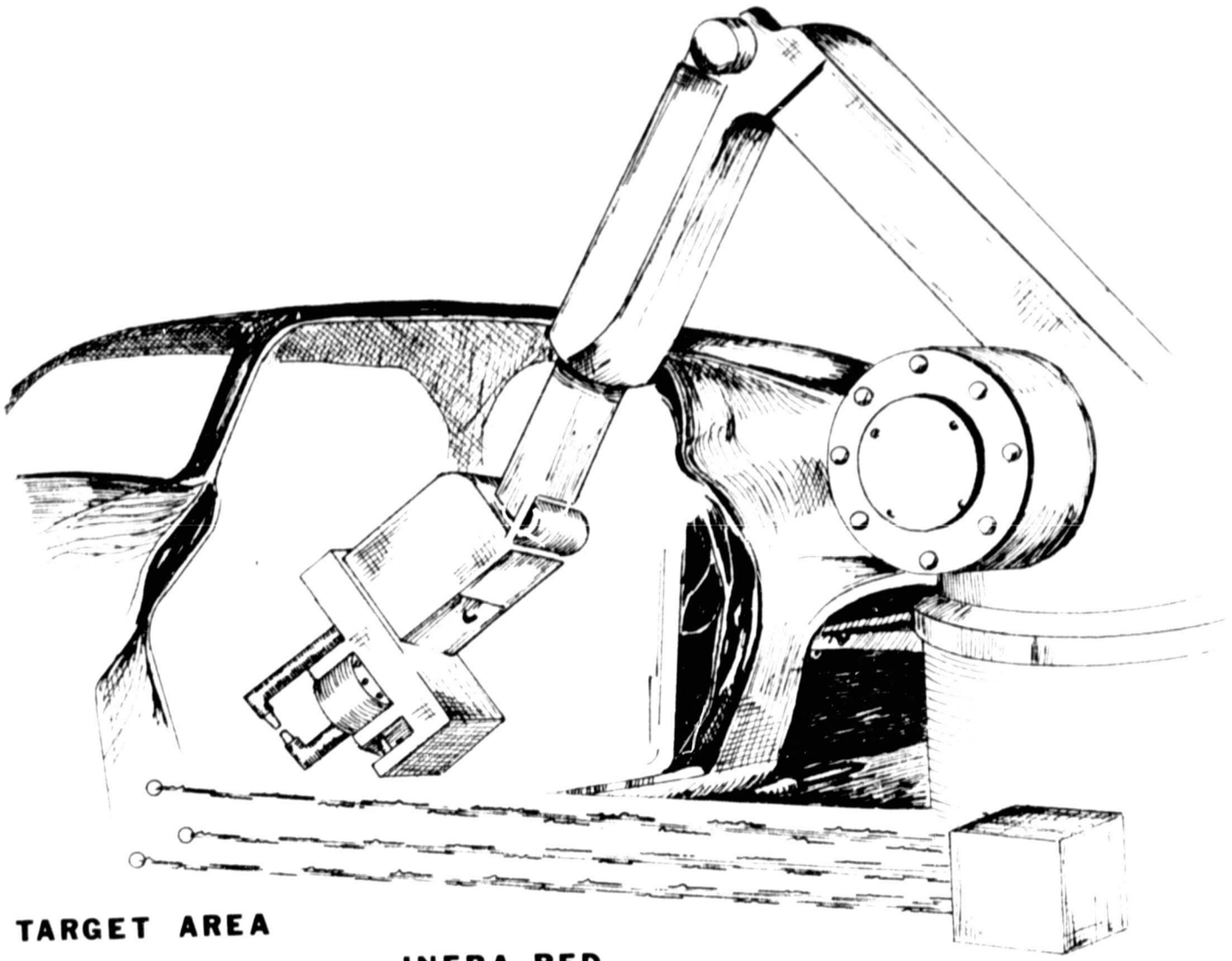
The Manufacturing Applications Team continues to expand and strengthen its reputation as industries communications link to aerospace manufacturing technology. The goals and objectives of the MATeam are rapidly becoming well understood by other government agencies. Agencies currently participating in the program include the Army, Navy and Air Force and will expand in the future. The major thrust in MATeam effort continues to be the development of joint funded RTOP programs.

MANUFACTURING APPLICATIONS TEAM ORGANIZATION

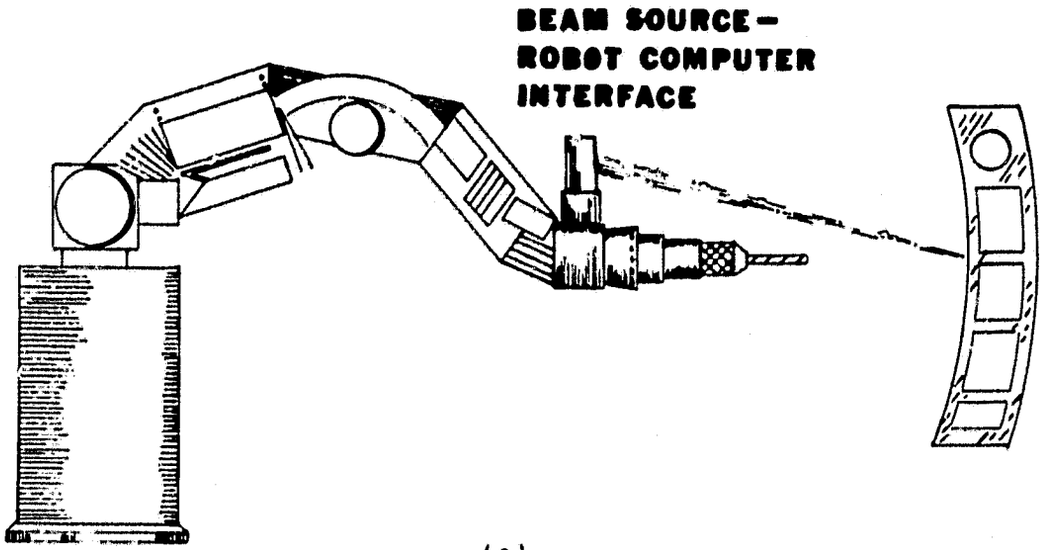


Enclosure 1

NASA INFRARED PROXIMITY DEVICE ESTABLISHING LOCATION
OF WELDMENT IN ACCURATE POSITIONING OF ROBOT FOR WELDING OPERATION

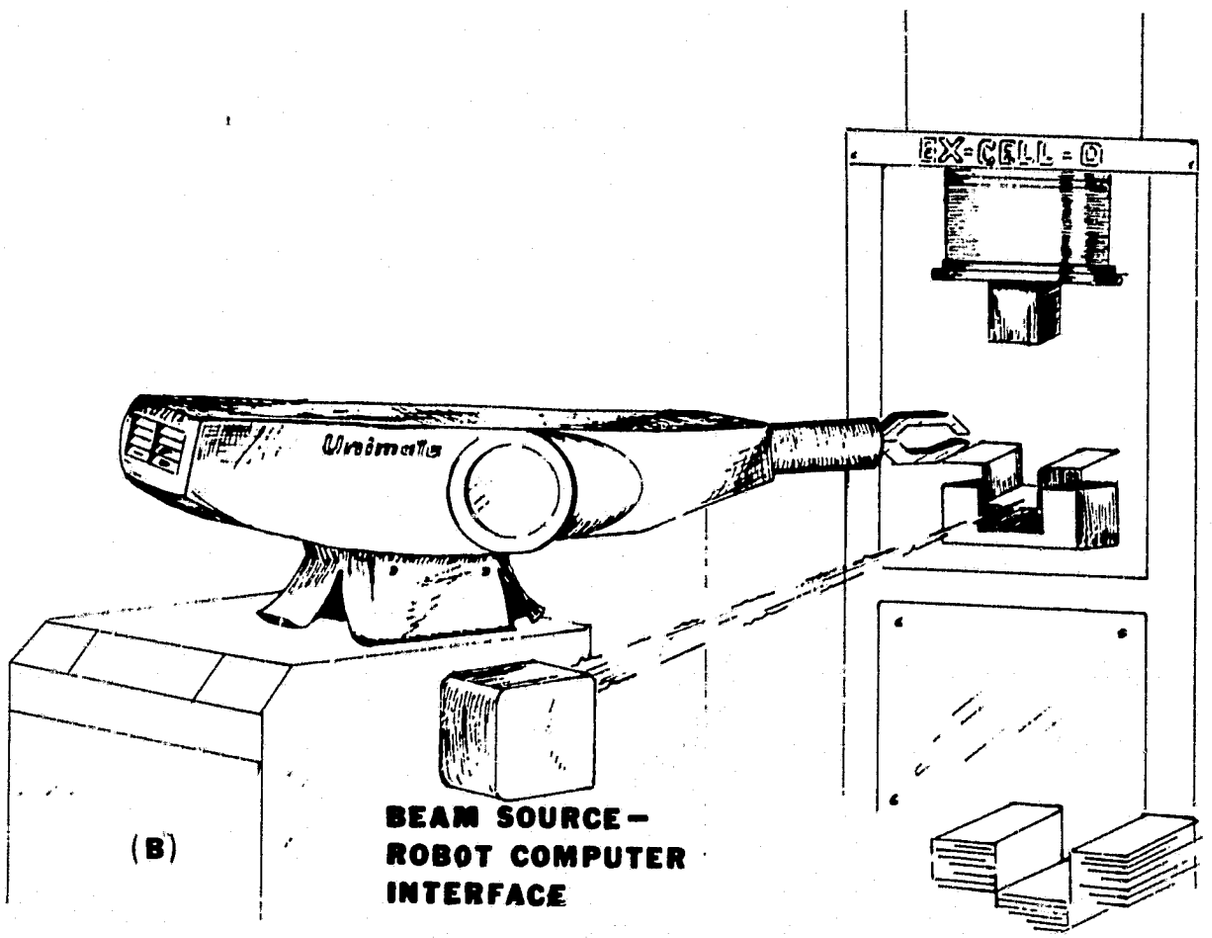


Enclosure 2



(A)

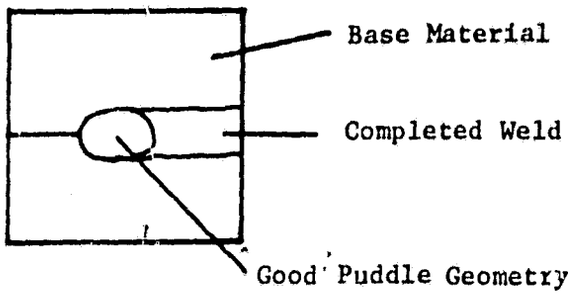
NASA INFRARED PROXIMITY DEVICE LOCATING HOLE IN ROBOT DRILLING OPERATION



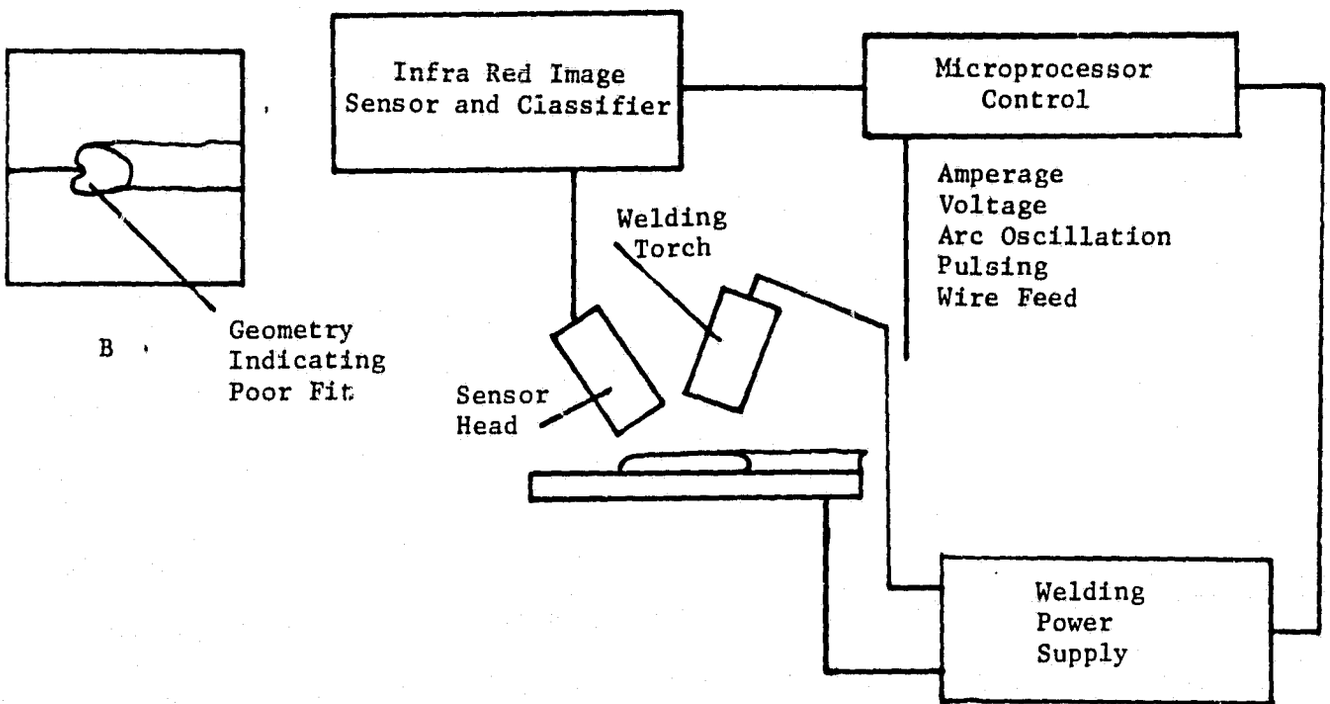
(B)

INFRARED PROXIMITY DEVICE DETECTING PART HANGUP THUS AVOIDING MACHINE DAMAGE

DIAGRAM OF REAL TIME INFRA RED WELD GEOMETRY SENSING SYSTEM



A



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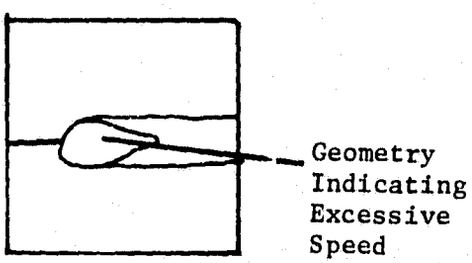
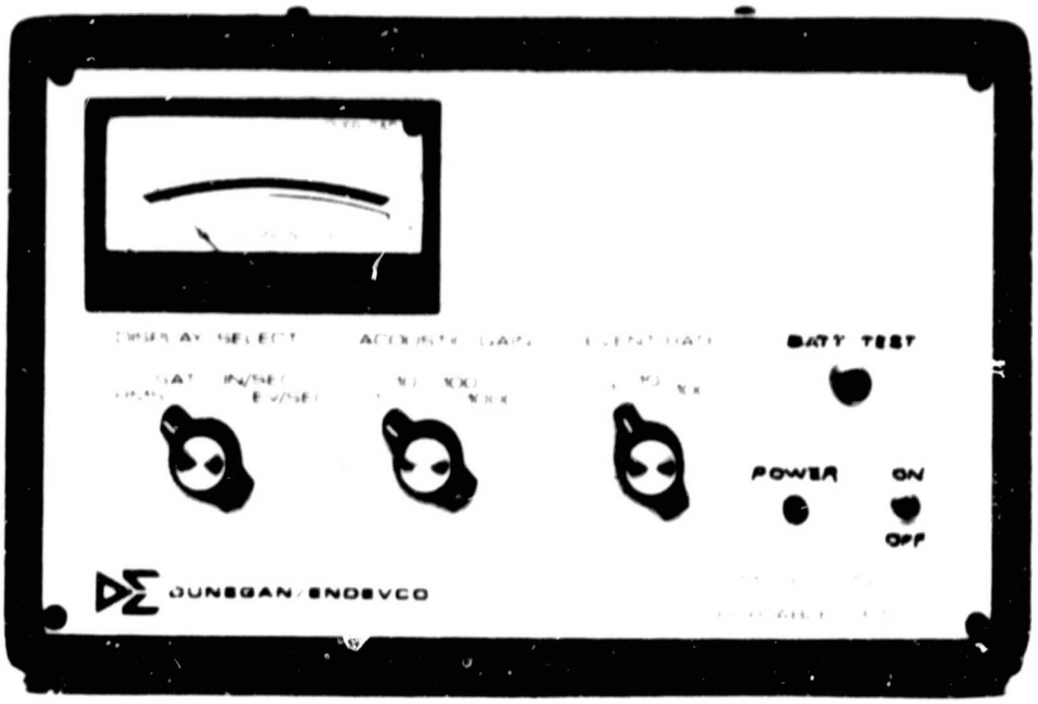
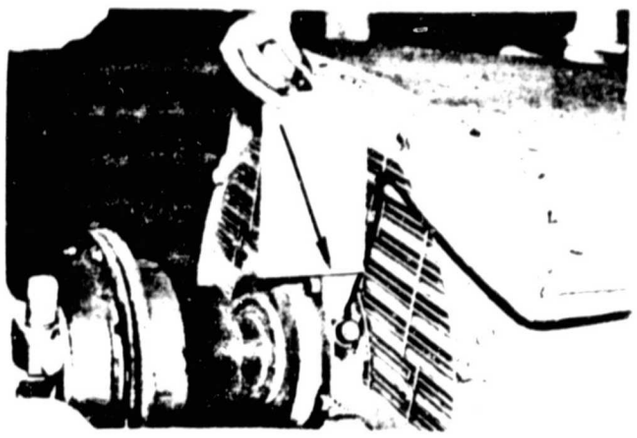


C

Enclosure 4



(A)



(B)

(A) DUNEGAN/ENDEVCO MODEL 5712 PORTABLE INCIPIENT FAILURE DETECTOR CONTROL

(B) CONTROL SENSOR TRANSDUCER LOCATED ON ELECTRIC MOTOR BEARING HOUSING AT EXXON CHEMICAL CO., BAYTOWN, TEXAS

Enclosure 5

SUMMARY OF MATEAM ACTIVITIES

	1977	1978	1979	Total
Industry Presentations	14	17	19	50
Company and Government Agency Visits	31	20	24	75
Technology Demonstrations	-	3	6	9
Other Contacts	467	259	285	1011
Problems Identified	150	89	57	296
Problem Statements Prepared	150	64	78	292
NASA Technology Identified	24	51	72	148
Solutions Assessed	8	46	18	72
Solution Strategies Developed	4	21	12	37
Applications Projects Started:				
RTOP Programs	-	3	8*	11
Industry Funded Applications Programs	-	4	2**	6
RFP Programs	-	2	-	2
Applications Projects Completed	-	3	-	3
Implementation Initiated	-	8	4+	12

* Orbital Tube Flaring, Laser Wire Insulation Stripper, Portable Solar Heating System, Biodigestion System, Fracture Toughness Testing Titanium Weldments, Infrared Robot Positioning, Infrared Imaging. Carbide Cutting Tool Coating

** Technology requiring additional development; nearing market implementation - Adams Manipulator Arm, Bolt Tension Monitor

\+ Technology presently being marketed - Wire Selector Calculator, A-C Motor Control (Modified Design), Bearing Failure Detector, Magnetic Hammer Coil Design.

Enclosure 6

MATEAM PRESENTATIONS

January 29, 1979	The Environmental Protection Agency (EPA) Noise Symposium Dallas, Texas
February 27, 1979	Borg-Warner Corporation Arlington Heights, Illinois
March 30, 1979	Valve Manufacturers Association Washington, D.C. Government Affairs Steering Committee
April 12, 1979	Artos Engineering Company New Berlin, Wisconsin
April 12, 1979	R.J. Wagner, Tubular Products Division Milwaukee, Wisconsin
May 1, 1979	Society of Manufacturing Engineers Annual Meeting Detroit, Michigan
May 14, 1979	Valve Manufacturers Association Annual Meeting Atlanta, Georgia
May 18, 1979	Illinois Tool Works Corporate Staff Rosemont, Illinois
June 4, 1979	Westinghouse Electric Machine Tool Forum Pittsburgh, Pennsylvania
June 12, 1979	Robot Institute of America Steering Committee Meeting Cincinnati Milicron Cincinnati, Ohio
August 8, 1979	Manufacturing Productivity Center IIT Research Institute Chicago, Illinois
August 15, 1979	Strippit-Houdaille Corp. Eng. Staff Buffalo, New York

Enclosure 7

MATEAM PRESENTATIONS (continued)

September 6, 1979	Rock Island Arsenal Mfs. Eng. Branch Rock Island, Illinois
September 6, 1979	Deere & Company Manufacturing Development Moline, Illinois
October 18, 1979	American Society for Nondestructive Testing Fall Conference St. Louis, Missouri
December 19, 1979	Unimation, Inc. Staff Danbury, Connecticut
January 15, 1980	Air Force Materials Laboratory Wright-Patterson, AFB, Dayton, Ohio
January 16, 1980	PRAM Office Wright-Patterson, AFB, Dayton, Ohio

MATEAM TECHNOLOGY DEMONSTRATIONS

March 1, 1979

Laser Wire Insulation Stripper
Rockwell Instrnational
Downey, California

- Alcoa
- AMP Inc.
- Boeing
- McDonnellDouglas
- Martin Marietta
- Westinghouse
- Motorola
- Eubanks Eng.
- Artos Eng. Co.

May 10, 1979

Orbital Tube Flaring Device
Marshall Space Flight Center, AL

- Grotnes Machine Works

August 20, 1979

NASA Robot Technology
Jet Propulsion Laboratory
Pasadena, Calif.

- Boeing
- Chesebrough Ponds
- General Dynamics
- Unimation
- Lockheed
- Cincinnati Milicron
- Northrup
- AFML/WPAFB
- DeVilbiss

September 24, 1979

Weld Skate Demonstration
Marshall Space Flight Center, AL

- Babcock and Wilcox
- Lockheed
- Cincinnati Milicron
- Merrick Eng.
- Deere & Co.
- Air Reduction Co.

November 24, 1979

Electromagnetic Hammer
NASA Michoud Assembly Facility
New Orleans, LA

- Peterson Boat Builders Inc.
- Harnischfeger Corp.
- Naval Coastal Systems
- Maxwell Corp.

Enclosure 8

MATEAM TECHNOLOGY DEMONSTRATIONS (continued)

November 24, 1979

Orbital Tube Flaring Device
Marshall Space Flight Center, AL
NAS-NARF-NORIS

IIT Research Institute
10 West 35 Street, Chicago, Illinois 60616
312/567-4000

NEWS RELEASE

Paula C. Norton
Manager, Public Relations
Ext. 4025

February 28, 1979

FOR IMMEDIATE RELEASE:

THE MAGNETIC HAMMER IS AN IMPORTANT TOOL IN NASA'S METALWORKING TOOL BOX

CHICAGO--NASA has solved the problem of distortion in aluminum weldments by using the magnetic hammer, a device that moves metal using interacting magnetic forces. This device, developed at the NASA Marshall Space Flight Center, has been used on space shuttle hardware applications and continues to be used in other straightening applications involving sheet and plate that has become distorted during welding.

The hammer is now available to industry through the NASA/IITRI Manufacturing Applications Team. Information on the device and planned future demonstrations may be obtained by contacting Mr. Edmund R. Bangs, MATeam Director, IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616 (312) 567-4191.

END

(PHOTOGRAPH ATTACHED)

Enclosure 9

IIT Research Institute
10 West 35 Street, Chicago, Illinois 60616
312/567-4000

NEWS RELEASE

Paula C. Norton
Manager, Public Relations
Ext. 4025

February 28, 1979

FOR IMMEDIATE RELEASE:

PRECISION TUBE FLARES OBTAINABLE USING ORBITAL TUBE FLARING DEVICE DEVELOPED AT NASA FIELD CENTER

CHICAGO--A precision tube flaring device, which utilizes the "Orbital Tube Flaring Concept," has been developed at the NASA Marshall Space Flight Center, Huntsville, Alabama. The orbiting die concept has been adapted to a Lakeland Tube Flaring Machine and provides reliable leak-proof connections in their critical high pressure tubing systems. The device is capable of producing precision flares on 1/8-inch to 1-inch stainless steel tubing, holding concentricity within 0.003" and roundness within 0.0008".

The device is now available to industry through the NASA/IITRI Manufacturing Applications Team and is part of the overall transfer of aerospace technology to industrial applications. Information on future demonstrations may be obtained by contacting Mr. Victor R. Fischer, MATeam Engineer, IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616 (312) 567-4264.

END

(PHOTOGRAPH ATTACHED)

Enclosure 10

IIT Research Institute
10 West 35 Street, Chicago, Illinois 60616
312/567-4000

NEWS RELEASE

Paula C. Norton
Ext. 4025

June 27, 1979

FOR IMMEDIATE RELEASE:

NASA WIRE SELECTOR/CALCULATOR AVAILABLE TO INDUSTRY

CHICAGO--NASA has developed a circular, slide-rule-type calculator as an aid to engineers and technicians in wiring system design. One of the device's capabilities includes rapid selection of wire gage when given wire length, current, voltage drop and temperature.

The calculator is being marketed by Electronic Relays, Inc., Downers Grove, Illinois.

Additional information pertaining to the calculator and other NASA manufacturing technology may be obtained by contacting Mr. Edmund R. Bangs, IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616 (312) 567-4191.

END

Enclosure 11

IIT Research Institute
10 West 35 Street, Chicago, Illinois 60616
312/567-4000

NEWS RELEASE

Paula C. Norton
Ext. 4025

August 7, 1979

FOR IMMEDIATE RELEASE:

EARLY WARNING BEARING FAILURE SYSTEM AVAILABLE FROM NASA

CHICAGO--The National Aeronautics and Space Administration reports that vibration and stress waves can warn of bearing failure and indicate its nature.

In an extensive experimental study, sensors detected the noises at frequencies from 10Hz to 1MHz, and their output was displayed as functions of time and frequency. Correlation of the results with known faults in the bearings showed that these measurements can discriminate between defective and acceptable bearings and can help identify the nature of the defect. Discrete faults as small as about 0.003 inch (0.075 mm) have been discerned by all the sensors used. Faults of about 0.001 inch (0.025 mm) were not obviously discernable.

Vibration and stress waves in the ultrasonic frequency range contain the information or primary value; in fact, the count rate of signals above 100 Hz is the strongest indication of failure propagation, with larger changes in this quantity than those of other methods. Therefore, the selection of a suitable sensor is critical to the utility of the system. Sensor selection and instrumentation are discussed at length in the report on this study.

-MORE-

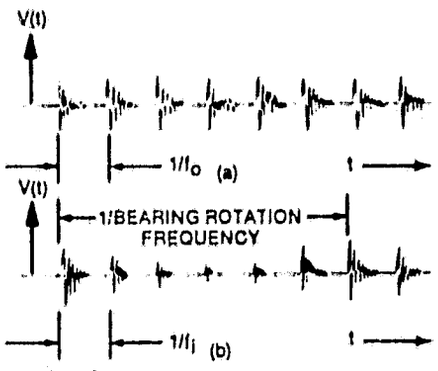
ADD ONE--EARLY WARNING BEARING FAILURE SYSTEM AVAILABLE FROM NASA

Excessive vibration and noise in a bearing can be traced to a surface fault that causes an impact to occur every time a defect is passed. The impact duration is generally quite short (on the order of 10 μs for a 207-size bearing with a surface fault about 10 mils (0.25 mm) wide). The frequency content of this impact extends well beyond the 100-kHz range and in some cases could even extend into the MHz range. This impact initiates a stress wave in the bearing system. Since the bearing system made of steel is a high Q structure, multiple reflection of the stress wave causes the bearing to resonate. Vibration and noise are the end products of this process.

Some characteristic frequencies employed for bearing-defect detection are the ball-pass frequencies for a discrete outer-race defect, inner-race defect, and ball defect. These frequencies are associated with the number of impacts per unit of time or the number of times a rolling element rolls over a defect either on the races or on the rolling element itself.

The waveforms below show typical signals in the time domain that would result from a single fault located on a raceway. In waveform (a) the decaying sinusoids repeat according to the ball-pass frequency for an outer-race fault, f_o. The decaying sinusoids relate to a natural resonance, and the individual ringdowns are quite alike in both amplitude and time duration. The wave in (b) shows the signal caused by an inner-race fault; though the sinusoids occur according to the ball-pass frequency for an inner-race fault, f_i, the individual bursts are not the same in amplitude or time duration.

ADD TWO--EARLY WARNING BEARING FAILURE SYSTEM AVAILABLE FROM NASA



The NASA system detects ultrasonic vibration waveforms generated by defects in the outer race and inner race of a ball bearing.

For additional information on this and other NASA technology, contact Mr. Victor Fischer (312)567-4264, NASA/IITRI Manufacturing Applications Team, 10 West 35th Street, Chicago, IL 60616.

News & Trends

OPERATIONS

NASA program offers help to manufacturers

Do you have a problem involving materials, processes, equipment, or management techniques which meet the following criteria:

- The problem is manufacturing related.
- The problem applies to more than one company.
- The solution to the problem is rooted in NASA technology.

If those statements describe your problem, you might be in line for some high-talent help via a free service sponsored by the National Aeronautics and Space Administration.

As part of its Technology Utilization Program, the agency is working with IIT Research Institute in a new program known as Manufacturing Application Team (MATeam).

MATeam identifies and documents manufacturing problems. The problem statement plays a key role in activities, enabling team members to focus their efforts. An edited version of the statement is circulated to technical personnel in the NASA field centers and laboratories in a search for any appropriate technology that might apply to the problem.

And since technology transfer is the main goal of the activity, once a successful solution is obtained, data will be disseminated to industry via news releases, conference presentations, etc.

Note that this overall approach to technology transfer contrasts sharply with previous NASA efforts. Up to now, that organization has concentrated on simply identifying new technology and, perhaps, seeking applications (solutions in search of a problem). MATeam's approach is to identify needs and then to determine if any relevant technology is available (problems in search of a solution).

Not only does the latter approach make NASA efforts more responsive to industry's needs, it opens the door for innovative solutions because of the unique technical expertise of NASA personnel.

An available report on an early warning bearing failure system is an example of MATeam activities. It describes an extensive study of bearing noises at frequencies from 10 Hz to 1 MHz.

Correlation of the results with known faults in the bearings showed that measurements can discriminate between defective and acceptable bearings and can help identify the nature of the defect.

Vibration and stress waves in the ultrasonic frequency range contain the information of primary value. The count rate of signals above 100 Hz is the strongest indication of failure propagation. Because a suitable sensor is so critical to a failure warning system, sensor selection and instrumentation are discussed at length in the report.

For additional information on the bearing failure warning system and other NASA technology, contact Victor Fischer (312) 567-4264, NASA/IITRI Manufacturing Applications Team, 10 West 35th St., Chicago, 60616.

INDUSTRY NEWS

Hammer out distortion magnetically

A manufacturing applications team from IIT Research Institute and the National Aeronautics and Space Administration is offering to industry a new device that eliminates distortion in weldments. Called the magnetic hammer, the device uses interacting magnetic forces to move metal. Engineers at the NASA Marshall Space

Flight Center first developed the hammer for use on space shuttle hardware, then used it for straightening sheet and plate that had become distorted during welding. For more information contact Edmund R. Bangs, IIT Research Institute, 10 West 35th Street, Chicago, Ill. 60616. Phone: (312) 567-4191.